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(54) **IMAGE FORMING APPARATUS THAT CHANGES A TRANSFER CONTROL PARAMETER FOR DIFFERENT AREAS OF A SHEET**

(71) Applicants: **KABUSHIKI KAISHA TOSHIBA**, Tokyo (JP); **TOSHIBA TEC KABUSHIKI KAISHA**, Tokyo (JP)

(72) Inventors: **Masato Ogasawara**, Tokyo (JP); **Koichiro Sato**, Shizuoka (JP)

(73) Assignees: **KABUSHIKI KAISHA TOSHIBA**, Tokyo (JP); **TOSHIBA TEC KABUSHIKI KAISHA**, Tokyo (JP)

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G03G 15/16 (2006.01)

(52) **U.S. Cl.**
CPC ***G03G 15/1615*** (2013.01); ***G03G 15/1675*** (2013.01); ***G03G 15/5054*** (2013.01); ***G03G 15/6564*** (2013.01); ***G03G 15/6591*** (2013.01); ***G03G 15/6594*** (2013.01); *B65H 2407/21* (2013.01); *G03G 2215/00059* (2013.01); *G03G 2215/00075* (2013.01); *G03G 2215/00156* (2013.01)

(58) **Field of Classification Search**
CPC G03G 15/5054; G03G 2215/00075
See application file for complete search history.

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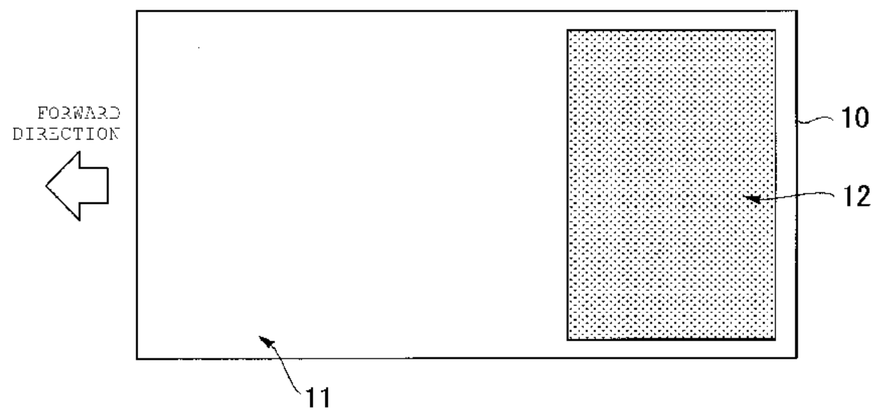
Primary Examiner — Victor Verbitsky
(74) *Attorney, Agent, or Firm* — Kim & Stewart LLP

(57) **ABSTRACT**

An image forming apparatus includes an image transfer unit configured to transfer an image formed on an image carrier to a sheet, according to a transfer control parameter, and a transfer control unit. The transfer unit is configured to set the transfer control parameter to a first value when a first portion of the image is being transferred to a first area of the sheet and to a second value when a second portion of the image is being transferred to a second area of the sheet transfers an image formed on an image carrier to a sheet.

12 Claims, 8 Drawing Sheets



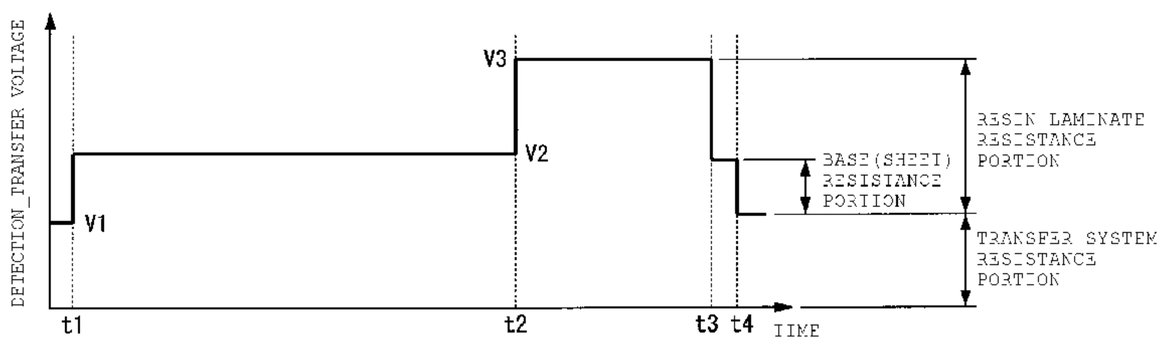


FIG. 1

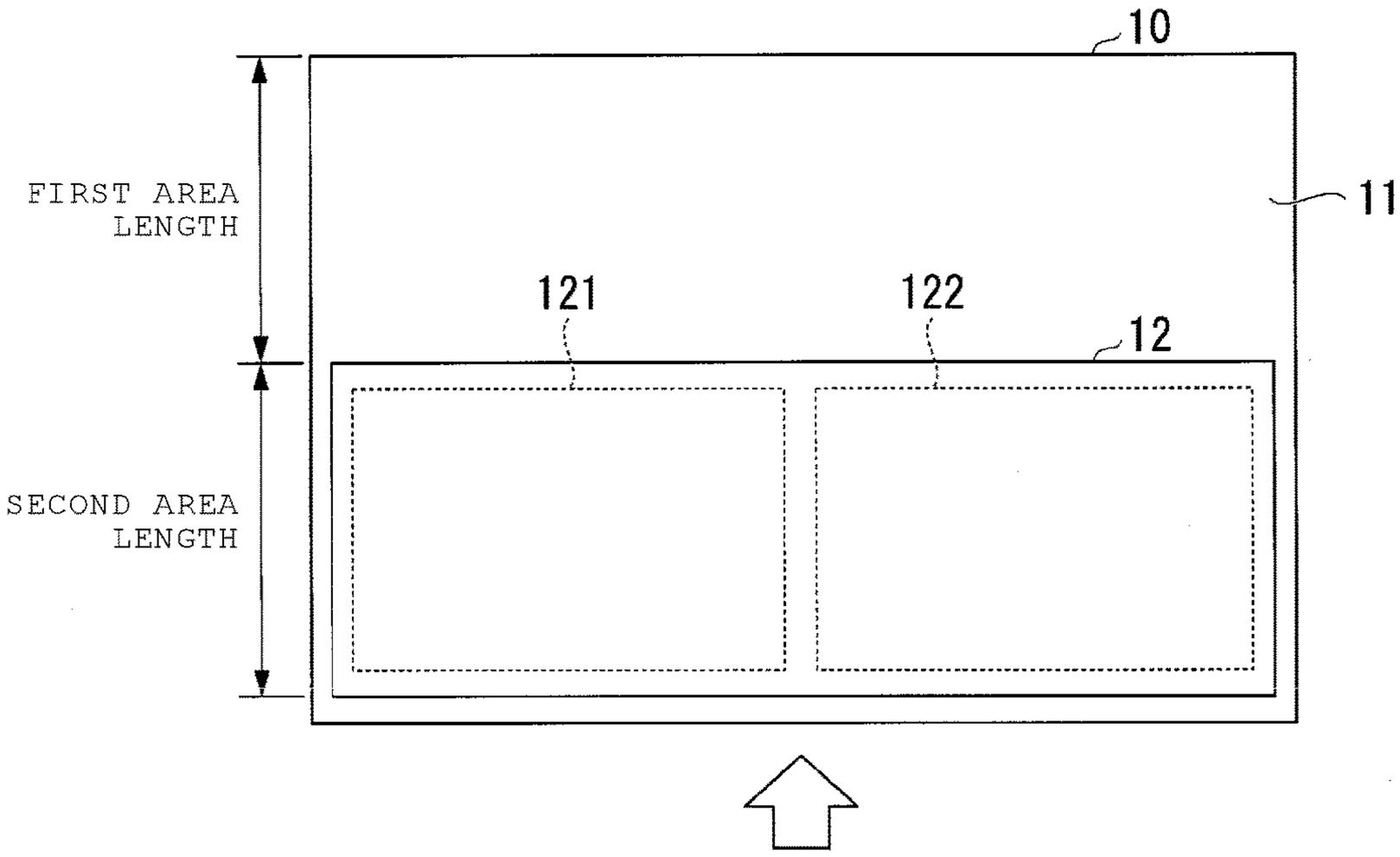

10
11
FIRST AREA LENGTH
121
122
12
SECOND AREA LENGTH
TRANSPORT DIRECTION

FIG. 2

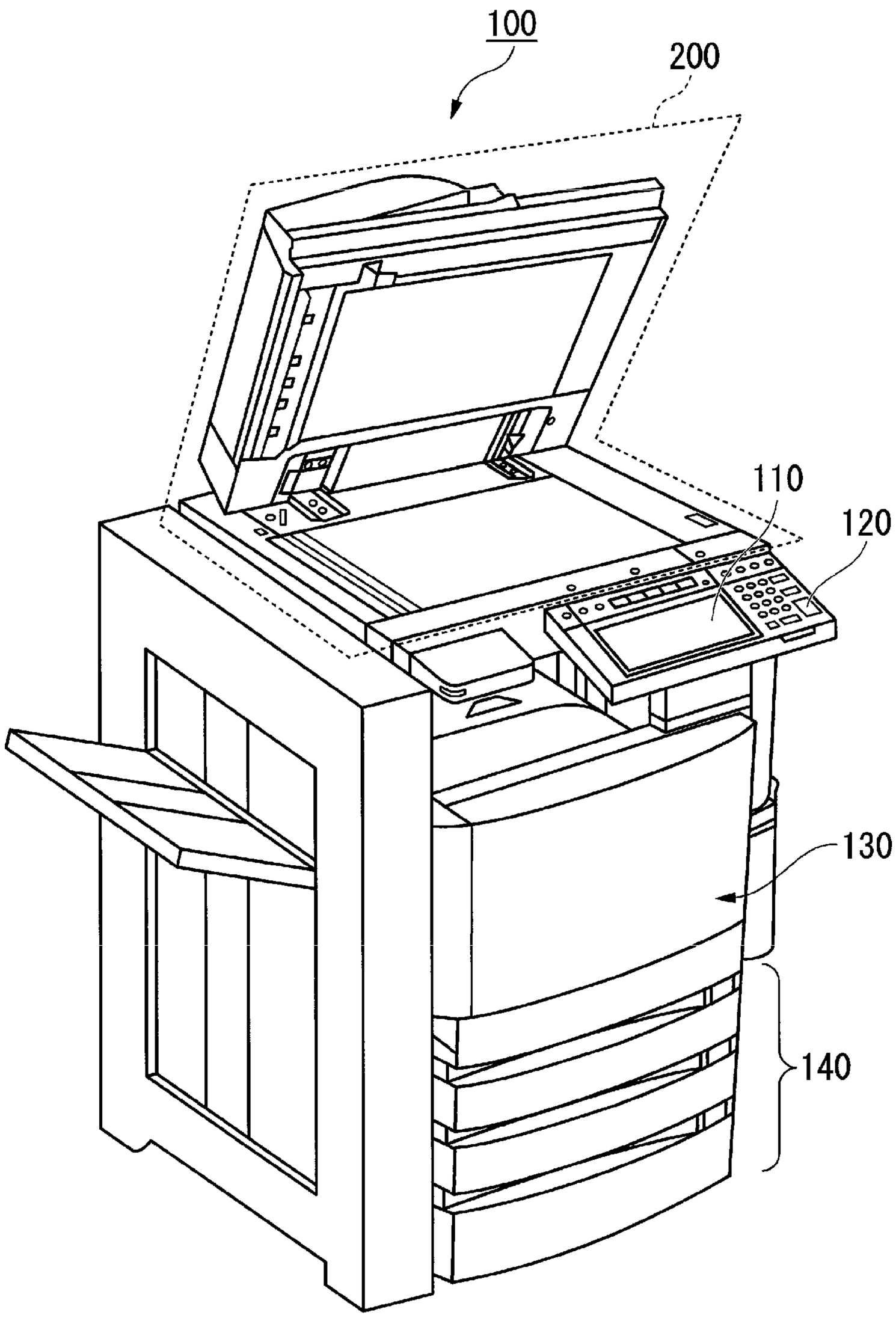


FIG. 3

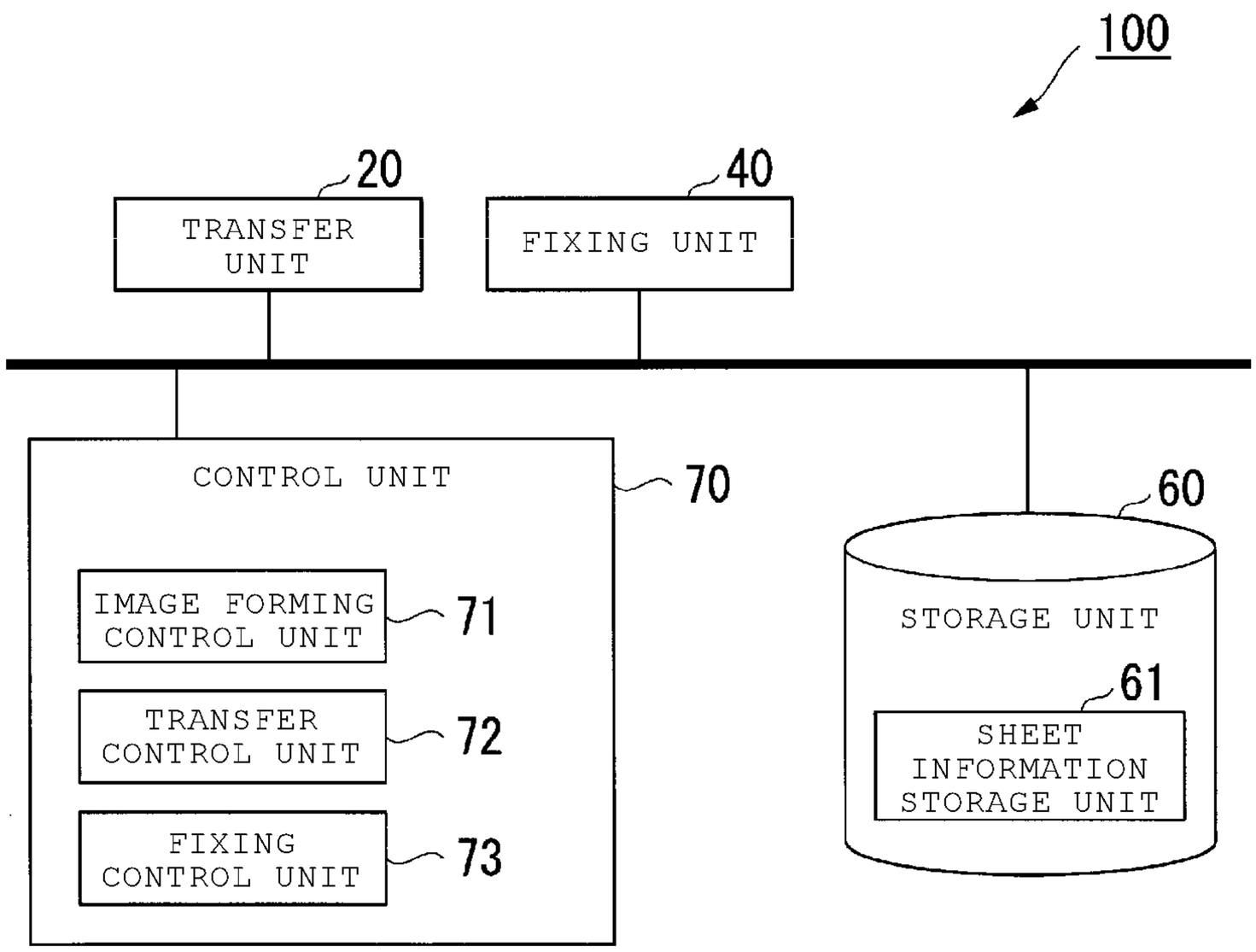

100
20
TRANSFER UNIT
40
FIXING UNIT
CONTROL UNIT
70
IMAGE FORMING CONTROL UNIT
71
TRANSFER CONTROL UNIT
72
FIXING CONTROL UNIT
73
60
STORAGE UNIT
61
SHEET INFORMATION STORAGE UNIT

FIG. 4

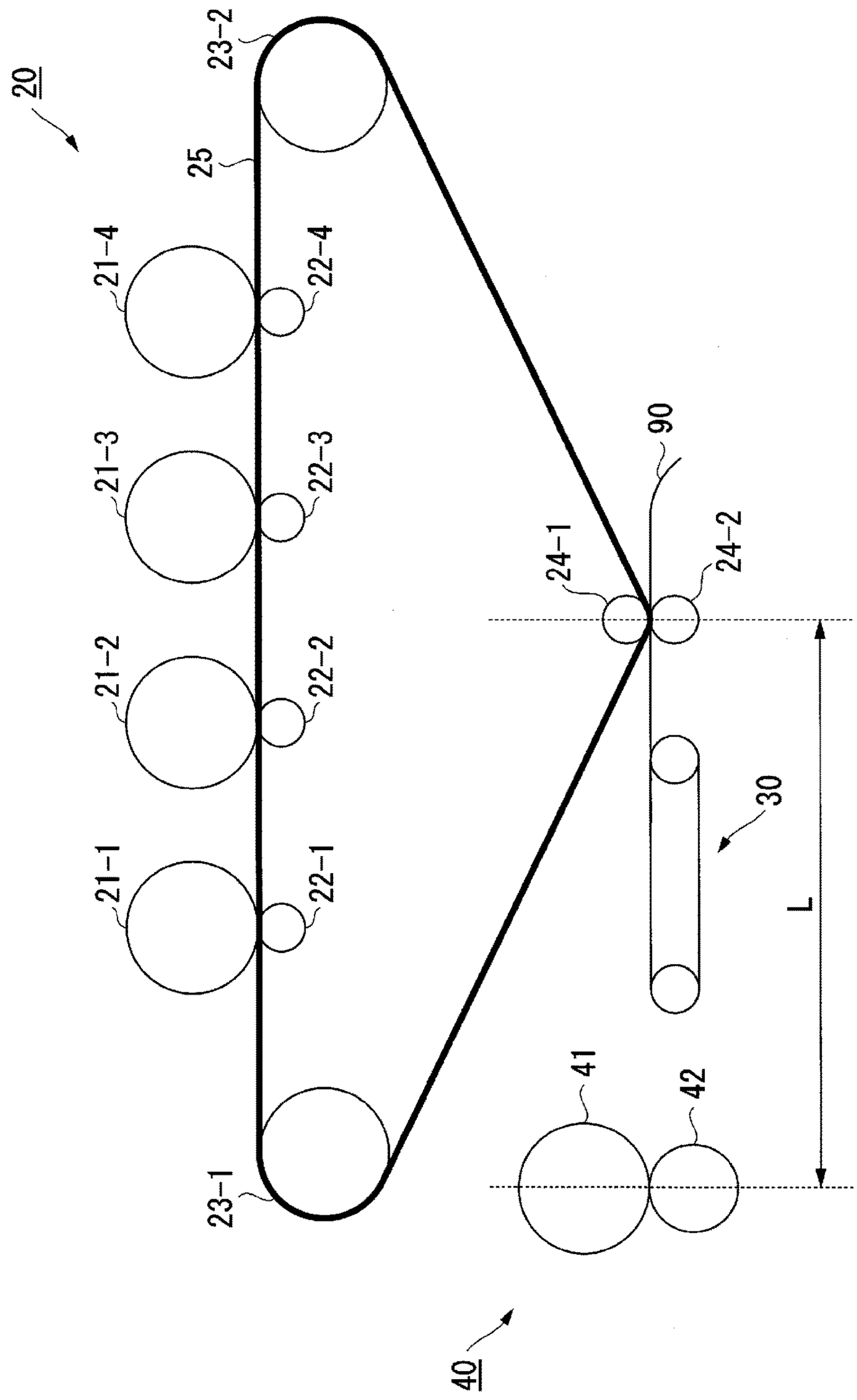

20
23-2
25
21-4
22-4
21-3
22-3
21-2
22-2
21-1
22-1
23-1
90
24-1
24-2
30
L
41
42
40

FIG. 5

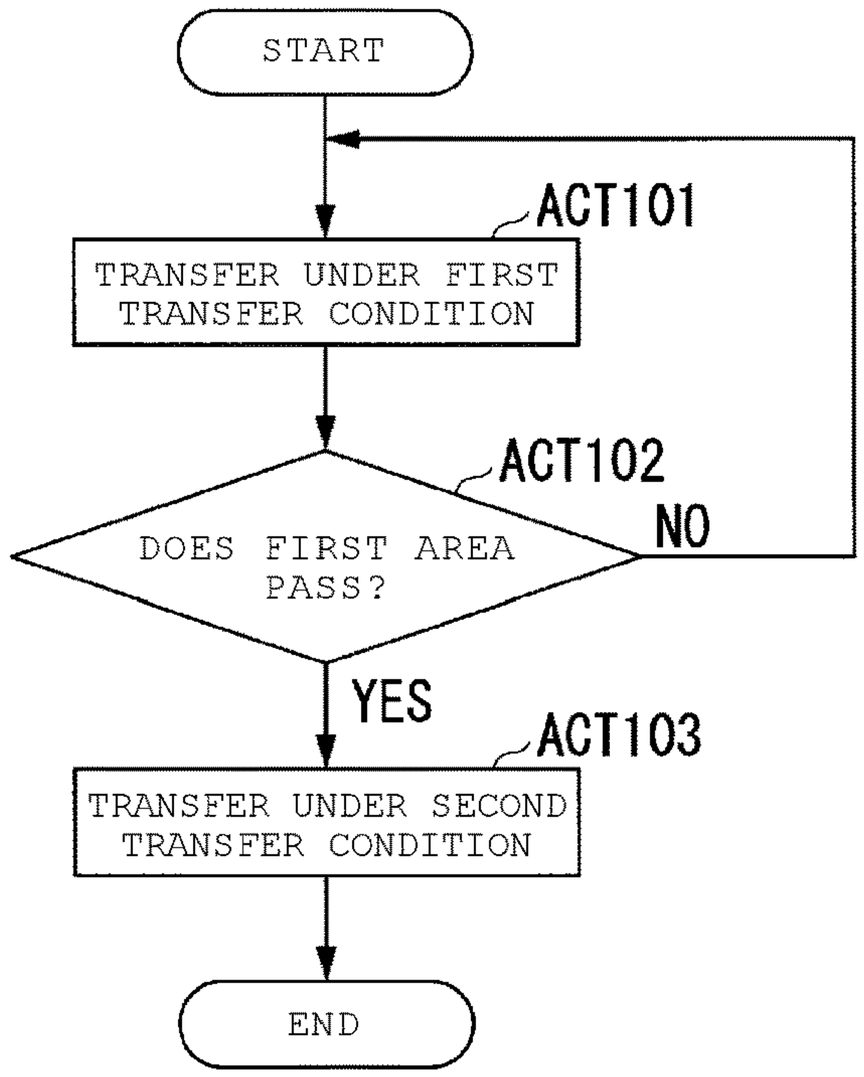

START
ACT101
TRANSFER UNDER FIRST TRANSFER CONDITION
ACT102
DOES FIRST AREA PASS?
NO
YES
ACT103
TRANSFER UNDER SECOND TRANSFER CONDITION
END

FIG. 6

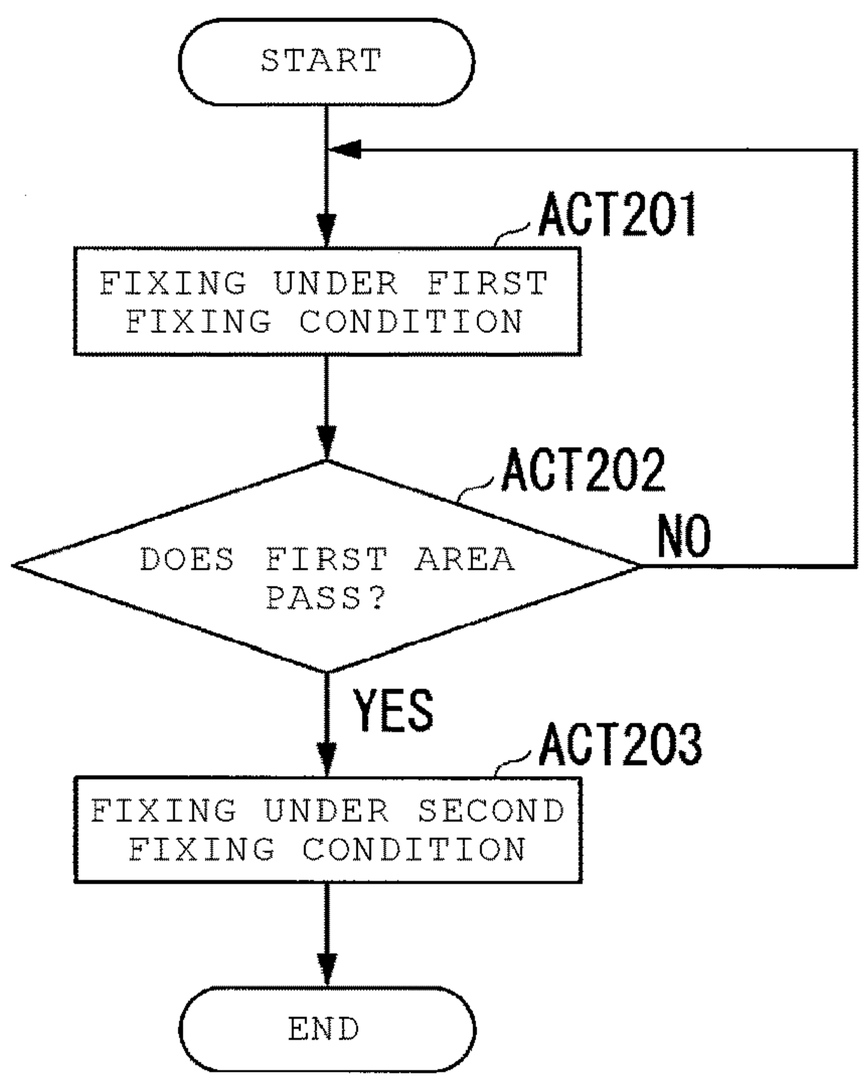

START
ACT201
FIXING UNDER FIRST FIXING CONDITION
ACT202
DOES FIRST AREA PASS?
NO
YES
ACT203
FIXING UNDER SECOND FIXING CONDITION
END

FIG. 7

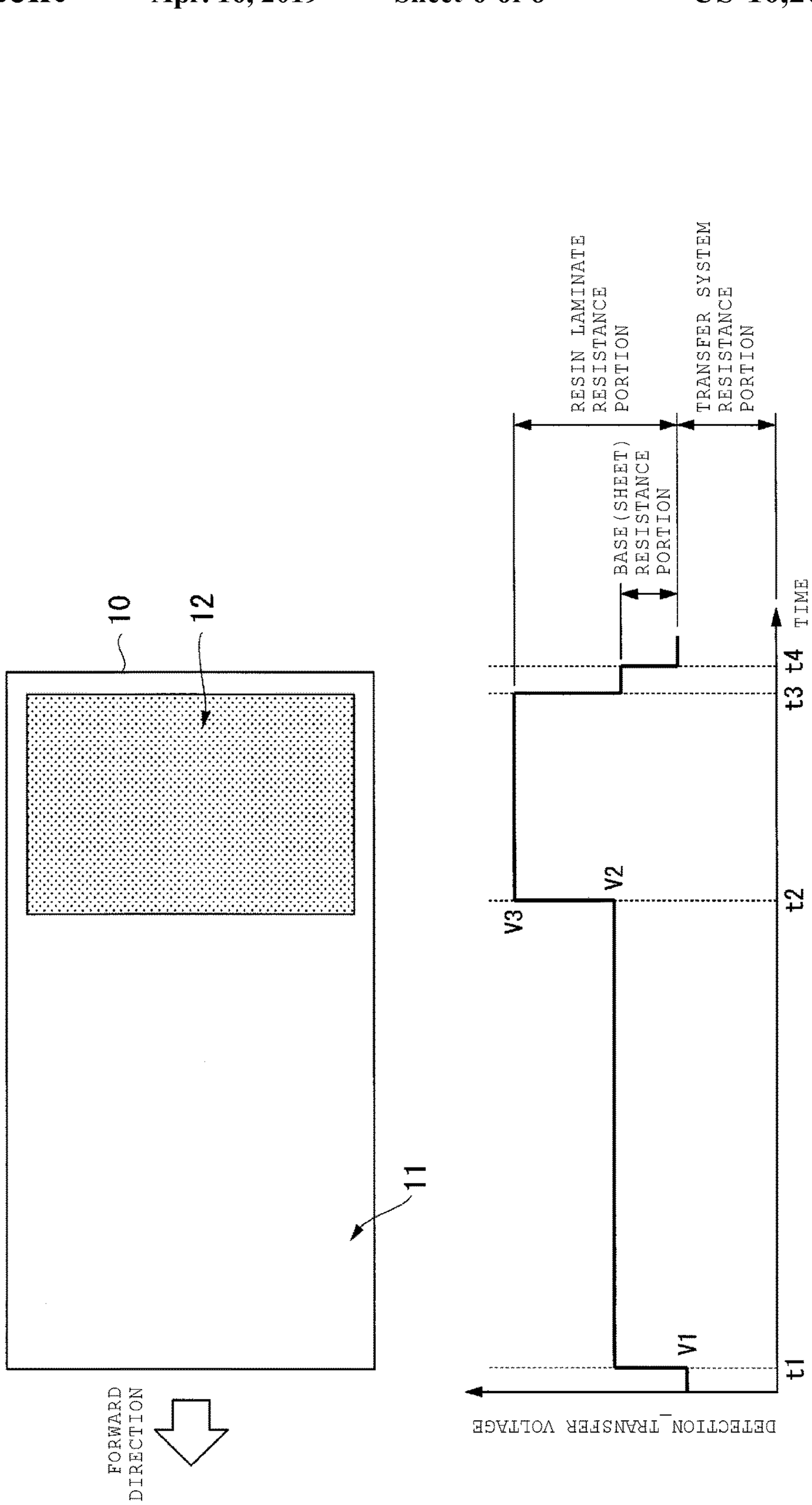

10
12
11
FORWARD DIRECTION
RESIN LAMINATE RESISTANCE PORTION
TRANSFER SYSTEM RESISTANCE PORTION
BASE(SHEET) RESISTANCE PORTION
V3
V2
V1
t1
t2
t3
t4
TIME
DETECTION_TRANSFER VOLTAGE

FIG. 8

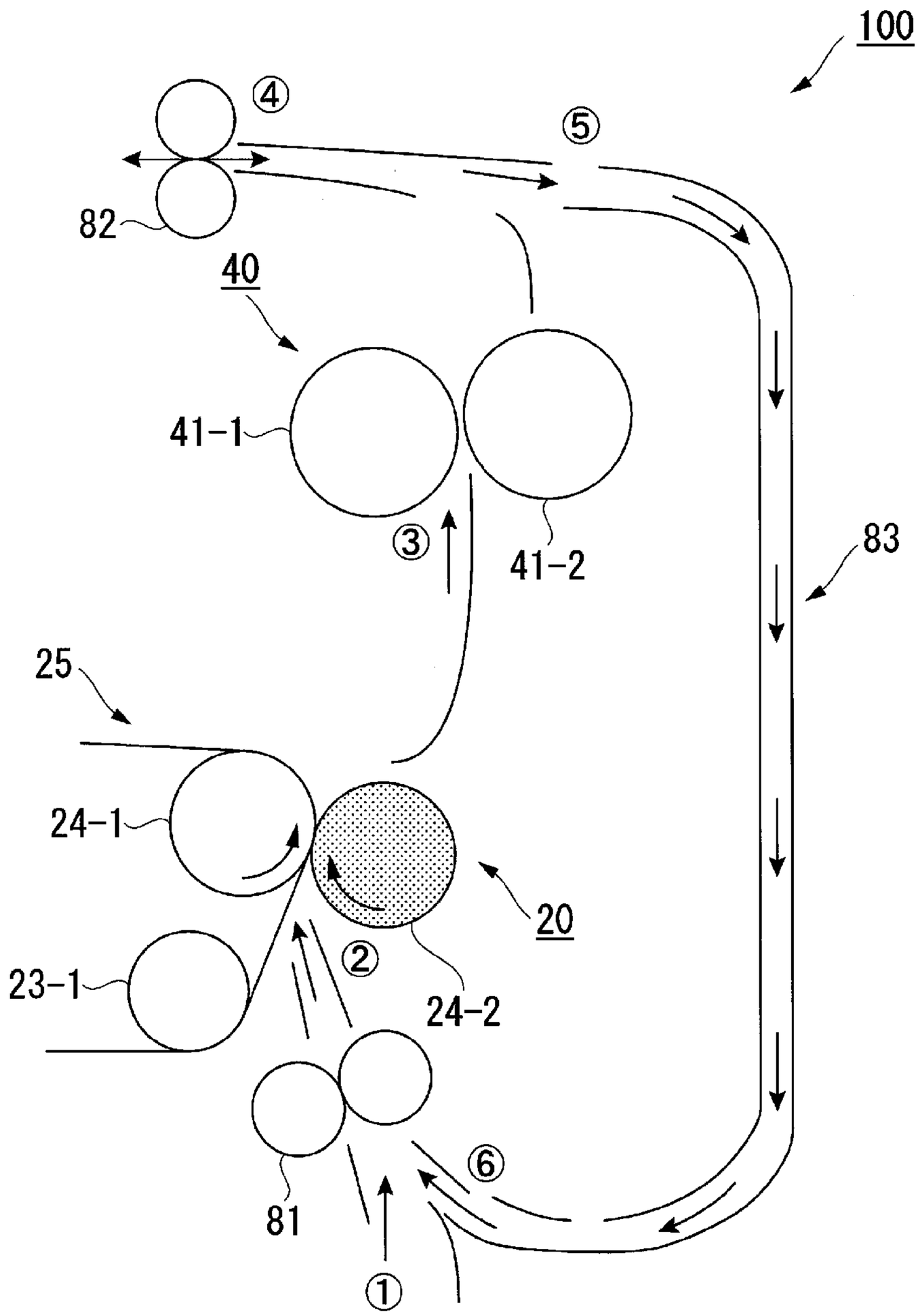


FIG. 9

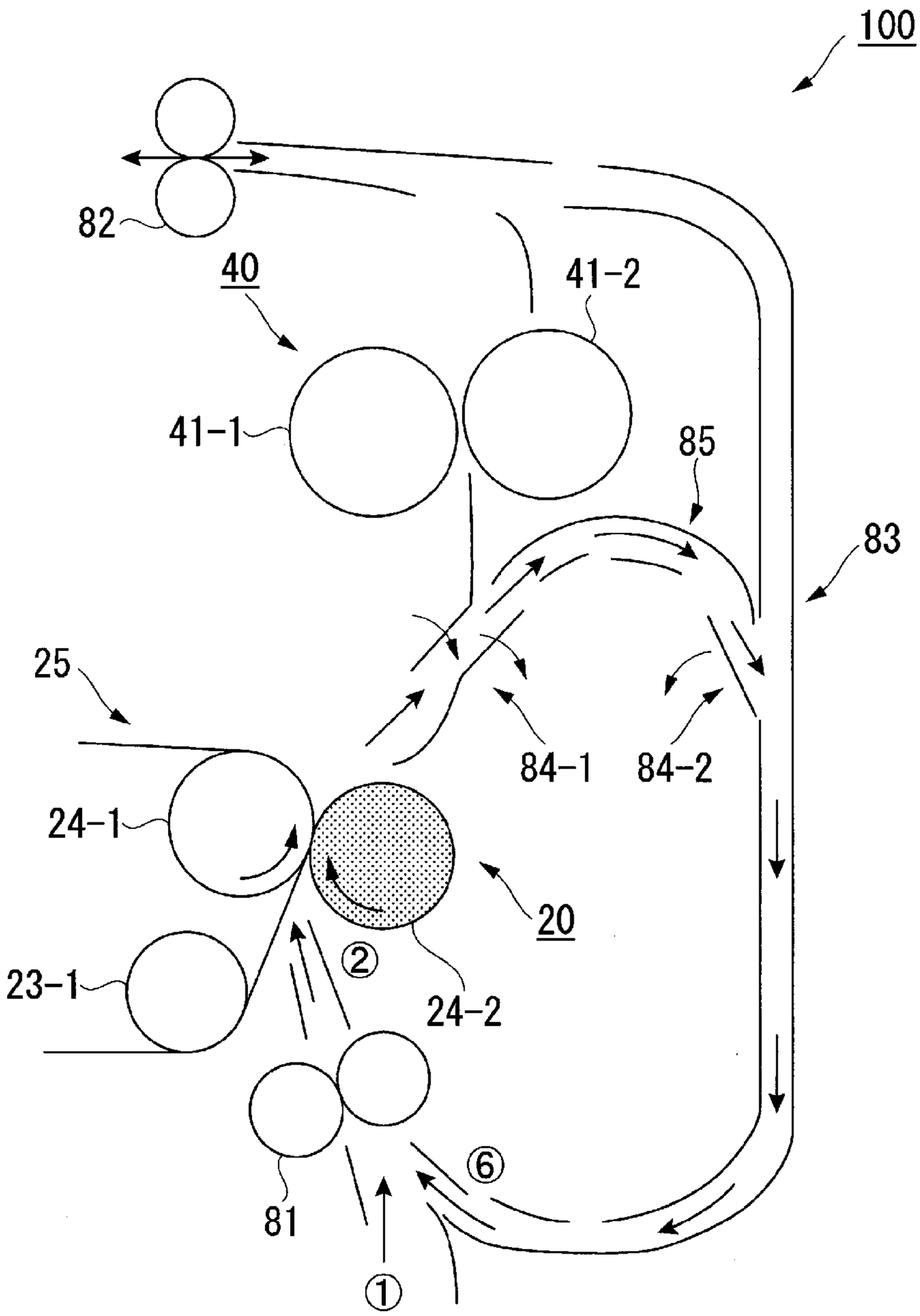


IMAGE FORMING APPARATUS THAT CHANGES A TRANSFER CONTROL PARAMETER FOR DIFFERENT AREAS OF A SHEET

This application is based upon and claims the benefit of priority from Japanese Patent Application No. 2017-011351, filed Jan. 25, 2017, the entire contents of which are incorporated herein by reference.

FIELD

Embodiments described herein relate generally to an image forming apparatus.

BACKGROUND

In the related art, there is a sheet having parts of which physical characteristics such as thicknesses or materials are different from each other in the sheet. In a case of forming an image on such a sheet (hereinafter, referred to as a "hybrid sheet") having a plurality of parts of which the physical characteristics are different from each other as described above, there is a case where image forming quality is reduced because of the non-uniformity. The reason is as described below. In forming the image on the hybrid sheet, an image forming condition is determined according to a condition of a physical characteristics (for example, the thickness and the material) of any of the parts. In this case, there may be a case where the determined image forming condition and an optimal image forming condition for another part do not coincide with each other.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagram illustrating an example of a hybrid sheet which is an image forming target of an image forming apparatus of an embodiment.

FIG. **2** is an external diagram illustrating an overall configuration example of an image forming apparatus of the embodiment.

FIG. **3** is a block diagram illustrating a functional configuration relating to image forming processing by the image forming apparatus of the embodiment.

FIG. **4** is a diagram illustrating a specific example of a printer unit of the image forming apparatus.

FIG. **5** is a flowchart depicting a flow of an operation of a transfer control unit in a case where an image forming target sheet is the hybrid sheet.

FIG. **6** is a flowchart depicting a flow of an operation of a fixing control unit in a case where an image forming target sheet is the hybrid sheet.

FIG. **7** is a diagram illustrating a specific example of a change in voltage value at each point on the hybrid sheet.

FIG. **8** is a diagram illustrating a specific example of the image forming apparatus.

FIG. **9** is a diagram illustrating a specific example of the image forming apparatus.

DETAILED DESCRIPTION

Embodiments provide an image forming apparatus that can improve a quality of image formation with respect to a hybrid sheet.

In general, according to one embodiment, an image forming apparatus includes an image transfer unit and a transfer control unit. The transfer unit is configured to set the transfer control parameter to a first value when a first portion of the image is being transferred to a first area of the sheet and to a second value when a second portion of the image is being transferred to a second area of the sheet.

Hereinafter, an image forming apparatus of an embodiment will be described with reference to the drawings.

OVERVIEW

First, an overview of an image forming apparatus of the embodiment will be described. FIG. **1** is a diagram illustrating an example of a hybrid sheet **10** which is subjected to an image forming process performed by the image forming apparatus of the embodiment. The hybrid sheet **10** has a plurality of parts of which the physical characteristics are different from each other. In the example shown in FIG. **1**, the hybrid sheet **10** includes a part in a first area **11** having a first physical characteristics and a part in a second area **12** having a second physical characteristics. The first area **11** is a part formed of a plain paper. The second area **12** is a part on which a seal **121** and a seal **122** provided by applying resin coating on the plain paper are formed. When using the sheet, the seal **121** and the seal **122** on the second area **12** can be peeled off.

In the first area **11**, an image is formed on the material of the plain paper. In the second area **12**, an image is formed on the material of the resin coating. Therefore, in the first area **11** and the second area **12**, the materials of the target parts which are subjected to the image forming process are different from each other. In addition, the second area **12** formed of the plain paper, adhesive layers of seal and resin coatings while the first area **11** is formed of only the plain paper. Therefore, in the first area **11** and the second area **12**, the thicknesses of the parts which are subjected to the image forming process are different from each other. In the example shown in FIG. **1**, the thickness of the first area **11** is smaller than that of the second area **12**.

In the image forming apparatus of the embodiment, the hybrid sheet **10** is conveyed in a direction in which the first area **11** and the second area **12** are arranged as shown in FIG. **1**, and the image forming process is performed on the hybrid sheet **10**. In the example in FIG. **1**, the hybrid sheet **10** is conveyed so that the image forming process is performed on the first area **11** prior to the second area **12**. A length of the first area **11** in a conveying direction may be referred to as a first area length, and a length of the second area **12** in the conveying direction may be referred to as a second area length.

DETAILS

Next, details of the image forming apparatus of the embodiment will be described. FIG. **2** is an external perspective view of an overall configuration example of an image forming apparatus **100** of the embodiment. The image forming apparatus **100** is, for example, a multifunction machine. The image forming apparatus **100** includes a display **110**, a control panel **120**, a printer unit **130**, a sheet accommodation unit **140**, and an image reading unit **200**.

The image forming apparatus **100** forms an image on a sheet using a developer such as toner. The sheet is, for example, a piece of paper or a piece of label paper. Anything can be used as the sheet as long as the image forming apparatus **100** can form an image thereon. Sheets on which the image forming apparatus **100** can form images include the hybrid sheet **10** described above.

The display **110** is an image displaying device such as a liquid crystal display or an organic electroluminescence (EL) display. The display **110** displays various information items relating to the image forming apparatus **100**.

The control panel **120** includes a plurality of buttons. The control panel **120** receives user's operation inputs. The control panel **120** outputs a signal according to the operation inputs performed by the user to a control unit (control unit **70** described below) of the image forming apparatus **100**. The display **110** and the control panel **120** may be integrally configured as an touch panel display.

The printer unit **130** forms an image on the sheet based on image information generated by the image reading unit **200** or image information received via a communication network. The printer unit **130** forms the image, for example, by performing processing described below. An image forming unit of the printer unit **130** forms an electrostatic latent image on a photosensitive drum (an image carrier) based on the image information. The image forming unit of the printer unit **130** forms a visible image by attaching a developer to the electrostatic latent image. A specific example of the developer is toner. A transfer unit (a transfer unit **20** described below) of the printer unit **130** transfers the visible image (toner image) onto the sheet. A fixing unit (a fixing unit **40** described below) of the printer unit **130** fixes the visible image on the sheet by heating and pressurizing the sheet. The sheet which is subjected to the image forming process may be a sheet accommodated in the sheet accommodation unit **140** or may be a manually fed sheet.

The sheet accommodation unit **140** accommodates sheets used for image forming process in the printer unit **130**.

The image reading unit **200** reads the image information of a read target as light brightness and darkness. The image reading unit **200** stores the read image information. The stored image information may be transmitted to another information processing device via a network. The stored image information may be formed on the sheet as an image by the printer unit **130**.

FIG. **3** is a block diagram illustrating a functional configuration relating to the image forming processing by the image forming apparatus **100** of the embodiment. The image forming apparatus **100** includes the transfer unit **20**, the fixing unit **40**, a storage unit **60**, and the control unit **70**. The transfer unit **20** forms the electrostatic latent image on the photosensitive drum based on the image information which is an image forming target. The transfer unit **20** forms the visible image by attaching developer on the electrostatic latent image. The transfer unit **20** transfers the visible image onto the sheet according to transfer conditions instructed by the control unit **70**. Transferring the visible image (toner image) on the photosensitive drum to an endless transfer belt (hereinafter, referred to as "transfer belt") is referred to as a primary transfer. In addition, transferring the visible image on the transfer belt to the sheet is referred to as secondary transfer. Hereinafter, a case of being merely described as a transfer indicates the secondary transfer. In addition, either a direct transfer method or an indirect transfer method may be applied to the transfer unit **20** of the image forming apparatus **100**.

The fixing unit **40** fixes the visible image onto the sheet by heating and pressurizing the sheet according to fixing conditions instructed by the control unit **70**.

The storage unit **60** is configured with a storage device such as a magnetic hard disk device or a semiconductor storage device. The storage unit **60** functions as a sheet information storage unit **61**. The sheet information storage unit **61** stores sheet information for each type of sheets. The sheet information is information relating to the physical characteristics of the sheet or information in which image forming information indicating the image forming conditions suitable for the sheet is defined for each type of sheets. In the following description, an example in which the sheet information is the image forming information will be described.

The image forming condition includes, for example, the transfer condition and the fixing condition. The transfer condition is an operation condition assumed to be suitable for performing the transfer to the sheet. The transfer condition is, for example, a value of a transfer voltage applied to a transfer roller. The fixing condition is an operation condition assumed to be suitable for performing the fixing to the sheet. The fixing condition includes a temperature (hereinafter, referred to as a "fixing temperature") of a fixing roller (not shown) and information (hereinafter, referred to as "conveyance information") relating to a time required for the sheet to pass through a nip portion. The conveyance information may be expressed as, for example, a conveying speed and a nip pressure.

The sheet information relating to the hybrid sheet **10** includes the image forming condition suitable for each of parts having different physical characteristics, a length of each part, and information (hereinafter, referred to as "arrival information") relating to a time required until processing is performed for each part. For example, the sheet information relating to the hybrid sheet **10** illustrated in FIG. **1** includes information relating to the first area **11** and information relating to the second area **12**.

The information relating to the first area **11** indicates the image forming condition for the first area **11**, the first area length, and a fact that the first area **11** is positioned at the top of the sheet in the conveying direction of the hybrid sheet **10**. The arrival information relating to the first area **11** may be expressed as, for example, "0" centimeter. In this case, the control unit **70** calculates a time from when it is started to perform processing (transfer processing or fixing processing) for the hybrid sheet **10** to when the processing reaches the first area **11**, by dividing the arrival information by the conveying speed at that time. The image forming condition relating to the first area **11** may be defined as, for example, transfer voltage V1 and a fixing temperature T1. In this case, the conveyance information may be defines as a constant value regardless of parts of the sheet.

The information relating to the second area **12** indicates the image forming condition relating to the second area **12**, the second area length, and a fact that the second area **12** is positioned at a second position in the conveying direction of the hybrid sheet **10**. The arrival information relating to the second area **12** may be expressed as, for example, "n" centimeter (n is the first area length). In this case, the control unit **70** calculates a time from when it is started to perform the processing (transfer processing or fixing processing) for the hybrid sheet **10** to when the processing reaches the second area **12**, by dividing the arrival information by the conveying speed at that time. The image forming condition relating to the second area **12** may be defined as, for example, transfer voltage V2 and a fixing temperature T2. In this case, as described above, the conveyance information may be defined as a constant value regardless of parts of the sheet. In the example in FIG. **1**, the respective values are defined as values having relationships of $V1<V2$ and $T1<T2$.

For example, in a case where the fixing temperature is constant regardless of parts of the sheet, the conveyance information may be defined as a value that varies according

to a part. Specifically, in a case where the nip pressure is constant, the conveying speed in the first area **11** may be defined as S1 and the conveying speed in the second area **12** may be defined as S2. In this case, the respective values are defined as values having a relationship of S1>S2.

The control unit **70** functions as an image forming control unit **71**, a transfer control unit **72**, and a fixing control unit **73** by executing a program using a CPU.

The image forming control unit **71** controls the image forming processing on the sheet. The image forming control unit **71** performs processing such as conveyance of the sheet in the conveying path, image reading processing, image correction processing, the transfer processing, the fixing processing, and sheet discharge processing. When performing the transfer processing, the image forming control unit **71** instructs the transfer control unit **72** to control the transfer unit **20**. When performing the fixing processing, the image forming control unit **71** instructs the fixing control unit **73** to control the fixing unit **40**.

The transfer control unit **72** controls the operation of the transfer unit **20**. For example, the transfer control unit **72** controls the transfer voltage value of the transfer unit **20** according to the sheet information of the image forming target sheet.

The fixing control unit **73** controls the operation of the fixing unit **40**. For example, the fixing control unit **73** controls the fixing temperature at the fixing unit **40**, the conveying speed, and the nip pressure according to the sheet information of the image forming target sheet.

FIG. **4** is a diagram illustrating a specific example of the printer unit **130** of the image forming apparatus **100**. The printer unit **130** includes the transfer unit **20**, an intermediate conveying unit **30**, and the fixing unit **40**.

The transfer unit **20** includes a plurality of photosensitive drums **21** (**21-1**, **21-2**, **21-3**, and **21-4**), a plurality of primary transfer rollers **22** (**22-1**, **22-2**, **22-3**, and **22-4**), a plurality of transfer conveying rollers **23** (**23-1** and **23-2**), secondary transfer rollers **24** (**24-1** and **24-2**), and a transfer belt **25**. The plurality of photosensitive drums **21** forms toner images corresponding to colors allocated to the respective drums. The primary transfer rollers **22** transfer the toner images formed on the photosensitive drums **21**, which are positioned opposite to the primary transfer rollers **22**, onto the outer circumferential surface of the transfer belt **25**. The transfer conveying rollers **23** rotates the transfer belt **25** in a predetermined direction at a predetermined speed. The secondary transfer rollers **24** transfer the toner image, which is transferred on the transfer belt **25**, onto a sheet **90** which is subjected to the image forming process by being charged by the transfer control unit **72**.

The intermediate conveying unit **30** conveys the sheet **90** on which the visible image is transferred by the transfer unit **20** to the fixing unit **40**. It is desirable that a length "L" from a position where the sheet **90** is sandwiched between the secondary transfer rollers **24** to a position where the sheet **90** is sandwiched in the fixing unit **40** via the intermediate conveying unit **30** is greater than the length of the sheet **90** in the conveying direction.

The fixing unit **40** includes a heat roller **41** and a pressure roller **42**. The heat roller **41** may include a heater therein. A temperature of the heater becomes the temperature controlled by the fixing control unit **73**. The pressure roller **42** is pressed toward the heat roller **41** by a pressure portion (for example, a spring) (not illustrated). By applying this pressing force, the nip portion is formed between the heat roller **41** and the pressure roller **42**.

FIG. **5** is a flowchart depicting a flow of the operation of the transfer control unit **72** in a case where the sheet which is subjected to image forming process is the hybrid sheet **10**. The transfer control unit **72** acquires the sheet information relating to the hybrid sheet **10** as an image forming target from the sheet information storage unit **61** in advance. The transfer control unit **72** determines a part which is a target of the first transfer processing based on the arrival information of each part. When the hybrid sheet **10** arrives at the transfer unit **20**, the transfer control unit **72** starts the transfer under the transfer condition of the part which becomes the target of the first transfer processing. In the example of hybrid sheet **10** in FIG. **1**, the transfer control unit **72** starts the transfer under the first transfer condition (ACT**101**).

Next, the transfer control unit **72** determines a part which is a target of the second transfer processing based on the arrival information of each part. In the example of the hybrid sheet **10** in FIG. **1**, the part which is the target of the second transfer processing is the second area **12**, and the transfer processing on the second area **12** starts after the hybrid sheet **10** is conveyed by the first area length. The transfer control unit **72** determines whether or not the first area **11** has completely passed through the transfer unit **20** (specifically, the position of the transfer unit **20** where the sheet is sandwiched between the secondary transfer rollers **24**) based on the conveying speed of the sheet and the first area length (ACT**102**). The transfer control unit **72** continues the transfer processing under the first transfer condition until the first area **11** completely passes through the transfer unit (No in ACT**102**). On the other hand, if the first area **11** passes (Yes in ACT**102**), the transfer control unit **72** starts the transfer under a second transfer condition (ACT**103**). Thereafter, the transfer control unit **72** continues the transfer processing under the second transfer condition until the transfer to the hybrid sheet **10** is finished (in the example shown in FIG. **1**, until the second area **12** completely passes through the position of the transfer unit **20** where the sheet is sandwiched between the secondary transfer rollers **24**).

FIG. **6** is a flowchart depicting a flow of an operation of the fixing control unit **73** in a case where the image forming target sheet is the hybrid sheet **10**. The fixing control unit **73** acquires the sheet information relating to the hybrid sheet **10** which is subjected to the image forming processing from the sheet information storage unit **61** in advance. The fixing control unit **73** determines a part which is the target of the first fixing processing based on the arrival information of each part. When the hybrid sheet **10** arrives at the nip portion of the fixing unit **40**, the fixing control unit **73** starts the fixing under the fixing condition of the part which is first subjected to the fixing processing. In the example of the hybrid sheet **10** in FIG. **1**, the fixing control unit **73** starts the fixing under the first fixing condition (ACT**201**).

Next, the fixing control unit **73** determines a part which is the target of the second fixing processing based on the arrival information of each part. In the example of the hybrid sheet **10** in FIG. **1**, the part which is the target of the second fixing processing is the second area **12**, and the fixing processing on the second area **12** starts after the hybrid sheet **10** is conveyed by the first area length. The fixing control unit **73** determines whether or not the first area **11** has passed through the fixing unit **40** (specifically, the position where the sheet is sandwiched by the fixing unit **40**) based on the conveying speed of the sheet and the first area length (ACT**202**). The fixing control unit **73** continues the fixing processing under the first fixing condition until the first area **11** has passed through the nip portion of the fixing unit **40** (No in ACT**202**). On the other hand, if the first area **11** has

passed through the nip portion (Yes in ACT**202**), the fixing control unit **73** starts the fixing under a second fixing condition (ACT**203**). Thereafter, the fixing control unit **73** continues the fixing processing under the second fixing condition until the fixing of the hybrid sheet **10** is finished (in the example shown in FIG. **1**, until the second area **12** has passed through the nip portion).

As described above, the image forming apparatus **100** of the embodiment changes the transfer condition and the fixing condition during the image forming processing for a hybrid sheet **10**. Therefore, it is possible to improve a quality of image forming process with respect to a sheet (hybrid sheet) having a plurality of parts of which physical characteristics such as a thicknesses or materials are different from each other. Specifically, the respective processings are performed under the transfer conditions and the fixing conditions corresponding to the respective areas at the timings when the transfer processing and the fixing processing are performed for the first area **11** and the second area **12** of the hybrid sheet **10**. Therefore, it is possible to achieve the effect described above.

Modification Example

The sheet information may not be the image forming information indicating the image forming conditions suitable for the sheet as described above, but may be information relating to the physical characteristics of the sheet. For example, the sheet information may include information (the thickness and the material) relating to the physical characteristics of each of the parts of which the physical characteristics are different from each other, the lengths of the parts, and the arrival information of the parts. In this case, the transfer control unit **72** and the fixing control unit **73** of the image forming apparatus **100** is configured to acquire the transfer condition and the fixing condition in accordance with the thickness and the material of the image forming target sheet. For example, the storage unit **60** may be configured to store the transfer condition and the fixing condition suitable for each thickness and each material of a sheet in advance. In this case, the transfer control unit **72** and the fixing control unit **73** acquire the suitable transfer condition and the suitable fixing condition from the storage unit **60** according to the information relating to the physical characteristics of the sheet acquired from the sheet information storage unit **61**.

The control unit **70** may be configured not to include the fixing control unit **73**. In this case, in the image forming processing on the hybrid sheet **10**, the image forming apparatus **100** performs the transfer processing on the first area **11** and the second area **12** under the transfer conditions corresponding to the respective areas. Even with this configuration, since the transfer processing corresponding to each area is performed, it is possible to improve the quality of image forming process.

The control unit **70** may be configured not to include the transfer control unit **72**. In this case, in the image forming processing on the hybrid sheet **10**, the image forming apparatus **100** performs the fixing processing on the first area **11** and the second area **12** under the fixing conditions corresponding to the respective areas. Even with this configuration, since the fixing corresponding to each area is performed, it is possible to improve the quality of image forming process.

In the example in FIG. **1**, two areas of which the physical characteristics are different from each other are present on the hybrid sheet **10**. Three or more areas of which the physical characteristics are different from each other may be present on the hybrid sheet **10** on which the image forming apparatus **100** forms images. In this case, each information relating to each area is stored in the sheet information storage unit **61**.

Method for Acquiring Sheet Information

Hereinafter, a plurality of methods by which the image forming apparatus **100** acquires the sheet information will be described.

First, a first acquisition method will be described. The image forming apparatus **100** may acquire the sheet information which is stored in another information processing device in advance by receiving the information via a communication network. An example of another information processing device is a server provided by a supplier who supplies the sheet products (particularly, the hybrid sheet). Another example of another information processing device is an information processing device (a personal computer, a smart phone, or a tablet) used by a user using the image forming apparatus **100**.

Next, a second acquisition method will be described. The image forming apparatus **100** may acquire the sheet information by reading an image provided in advance on a packing material that packs the sheet (particularly, the hybrid sheet). This image may be provided as, for example, a barcode or a two-dimensional barcode. In this case, the user registers the sheet information in the image forming apparatus **100** using a predetermined barcode reader. For example, the barcode reader may be connected to the image forming apparatus **100** or may be connected to another information processing device (for example, the personal computer, the smart phone, or the tablet). In addition, another information processing device may function as a barcode reader.

Next, a third acquisition method will be described. The image forming apparatus **100** may acquire the sheet information from a storage medium provided in advance on a packing material that packs the sheet (particularly, the hybrid sheet). This storage medium may be configured with, for example, an RFID tag. In this case, the user registers the sheet information in the image forming apparatus **100** using a predetermined RFID tag reader. For example, the RFID tag reader may be provided in the image forming apparatus **100**, may be connected to the image forming apparatus **100**, or may be connected to another information processing device (for example, the personal computer, the smart phone, or the tablet). In addition, another information processing device may function as the RFID tag reader.

Next, a fourth acquisition method will be described. The image forming apparatus **100** may acquire the sheet information by conveying the sheet without forming the image. Hereinafter, the fourth acquisition method will be described in detail.

The image forming apparatus **100** executing the fourth acquisition method performs an operation in an operation mode (hereinafter, referred to as an "adjustment mode") for acquiring the sheet information on the conveying path. In a case of operation in the adjustment mode, the transfer control unit **72** applies a transfer voltage or current value that is assumed to be suitable according to the conveying speed in advance to the secondary transfer roller **24** by a constant voltage or current control during a period from when at least the sheet enters the transfer unit **20** to when the sheet finishes to pass through the transfer unit **20**. At this time, the transfer

control unit **72** detects a temporal change of a voltage value in the secondary transfer roller **24** using a voltage measuring device (not illustrated).

FIG. **7** is a diagram illustrating a specific example of a change in voltage value at each point on the hybrid sheet **10**. A voltage value v1 before time t1 is a voltage value in a state in which the sheet is not sandwiched between the secondary transfer rollers **24**. The voltage value v2 between time t2 and time t3 is a voltage value in a state in which the first area **11** of the hybrid sheet **10** is sandwiched between the secondary transfer rollers **24**. The voltage value v3 between time t3 and time t4 is a voltage value in a state in which the second area **12** of the hybrid sheet **10** is sandwiched between the secondary transfer rollers **24**. By measuring the voltage values in the respective areas as described above, the transfer control unit determines the transfer conditions suitable for the respective areas. The transfer control unit **72** may determine the length of each area according to the conveying speed and the timing of the change of the voltage value. The transfer control unit **72** may register the sheet information obtained as described above in the sheet information storage unit **61**.

When the sheet is conveyed along the conveying path in this adjustment mode, if the temperature of the fixing unit **40** is controlled at a temperature same as that at the time of image forming process, the sheet is heated. In this case, moisture contained in the sheet is vaporized, and it is concerned that the physical characteristics of the sheet might be changed. FIG. **8** and FIG. **9** are diagrams illustrating specific examples of the image forming apparatus **100** having means for solving such a problem.

In FIG. **8**, the image forming apparatus **100** includes a duplex printing conveying path **83** that connects from a part forward of a sheet discharge roller **82** to an aligning roller **81**. In the adjustment mode, the sheet which passed through the fixing unit **40** returns to the aligning roller **81** via the duplex printing conveying path **83**. When the sheet is conveyed along this path in the adjustment mode, the fixing control unit **73** controls the temperature of the fixing unit **40** to be lower than that at the time of image forming process. For example, the fixing unit **40** may be controlled such that the heater is in off state. Then, the control unit **70** changes the mode from the adjustment mode to a mode for performing image forming process, and performs image forming process on the sheet that arrives at the aligning roller **81** after passing through the duplex printing conveying path **83**. By performing the above-described processing, it is possible to prevent the sheet from being heated at a temperature same as that at the time of image forming process and the physical characteristics from being changed. Therefore, it is possible to perform the appropriate image forming process on the sheet used in the adjustment mode based on the value measured in the adjustment mode.

In FIG. **9**, the image forming apparatus **100** includes drive branch guides **84-1** and **84-2** between the transfer unit **20** and the fixing unit **40**. In addition, the image forming apparatus **100** includes a return guide **85**. The image forming control unit **71** conveys the sheet that passes through the transfer unit **20** not to the fixing unit **40** but to the return guide **85** by driving the drive branch guides **84-1** and **84-2** in the operation in the adjustment mode. The sheet conveyed to the return guide **85** is conveyed to the duplex printing conveying path **83** via the return guide **85**, and arrives at the aligning roller **81**. Then, the control unit **70** changes the mode from the adjustment mode to the mode for performing image forming process, and performs image forming process on the sheet that arrives at the aligning roller **81**. Since the above-described processing does not pass the sheet through the fixing unit **40**, it is possible to prevent the sheet from being heated and the physical characteristics from being changed. Therefore, it is possible to perform the appropriate image forming process on the sheet used in the adjustment mode based on the value measured in the adjustment mode.

As described above, four detailed examples of sheet information acquisition methods are described. However, the sheet information may be acquired by the image forming apparatus **100** using another method.

While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the inventions. Indeed, the novel embodiments described herein may be embodied in a variety of other forms; furthermore, various omissions, substitutions and changes in the form of the embodiments described herein may be made without departing from the spirit of the inventions. The accompanying claims and their equivalents are intended to cover such forms or modifications as would fall within the scope and spirit of the inventions.

What is claimed is:

1. An image forming apparatus comprising:

an image transfer roller configured to transfer an image formed on an image carrier to a sheet, according to a transfer control parameter; and

a controller configured to:

during an adjustment mode during which no image is formed on the image carrier, cause a constant current to be applied to the image transfer roller while the sheet passes through the image transfer roller and measure a voltage of the image transfer roller using a voltage measuring device as the sheet passes through the image transfer roller, to detect a first area and a second area of the sheet; and

during an image forming mode, set the transfer control parameter to a first value when a first portion of the image is being transferred to the first area of the sheet and to a second value when a second portion of the image is being transferred to the second area of the sheet.

2. The image forming apparatus according to claim **1**, wherein the transfer control parameter is a value of a voltage applied to the image transfer roller.

3. The image forming apparatus according to claim **1**, wherein the first value and the second value are determined based on the measured voltages.

4. The image forming apparatus according to claim **1**, further comprising:

an image fixing roller configured to fix the image on the sheet, according to a fixing control parameter, wherein

the controller is configured to set, during the image forming mode, the fixing control parameter to a third value when the image fixing roller fixes the first portion of the image on the first area of the sheet and to a fourth value when the image fixing roller fixes the second portion of the image on the second area of the sheet.

5. The image forming apparatus according to claim **4**,

wherein the fixing control parameter is a fixing temperature, a sheet conveyance speed through the image fixing roller, or both.

6. The image forming apparatus according to claim **4**, wherein the third value and the fourth value are a temperature of the image fixing roller, and the controller is further configured to set, during the adjustment mode, the tempera-

ture of the image fixing roller to a fifth value lower than the third value and the fourth value.

7. The image forming apparatus according to claim **4**, wherein the controller is further configured to turn off heating of the image fixing roller during the adjustment mode.

8. The image forming apparatus according to claim **4**, wherein the controller is further configured to change a sheet conveyance path during the adjustment mode, such that the sheet returns toward the image transfer roller without passing the image fixing roller.

9. The image forming apparatus according to claim **1**, wherein the first area of the sheet and the second area of the sheet have different thicknesses.

10. The image forming apparatus according to claim **1**, wherein the first area of the sheet and the second area of the sheet are at least partially formed with different materials.

11. The image forming apparatus according to claim **10**, wherein the first area of the sheet contains no resin coating, and the second area of the sheet contains a resin coating.

12. The image forming apparatus according to claim **10**, wherein the first area of the sheet contains no adhesion layer, and the second area of the sheet contains an adhesion layer.

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